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# PATENT ABSTRACTS OF JAPAN

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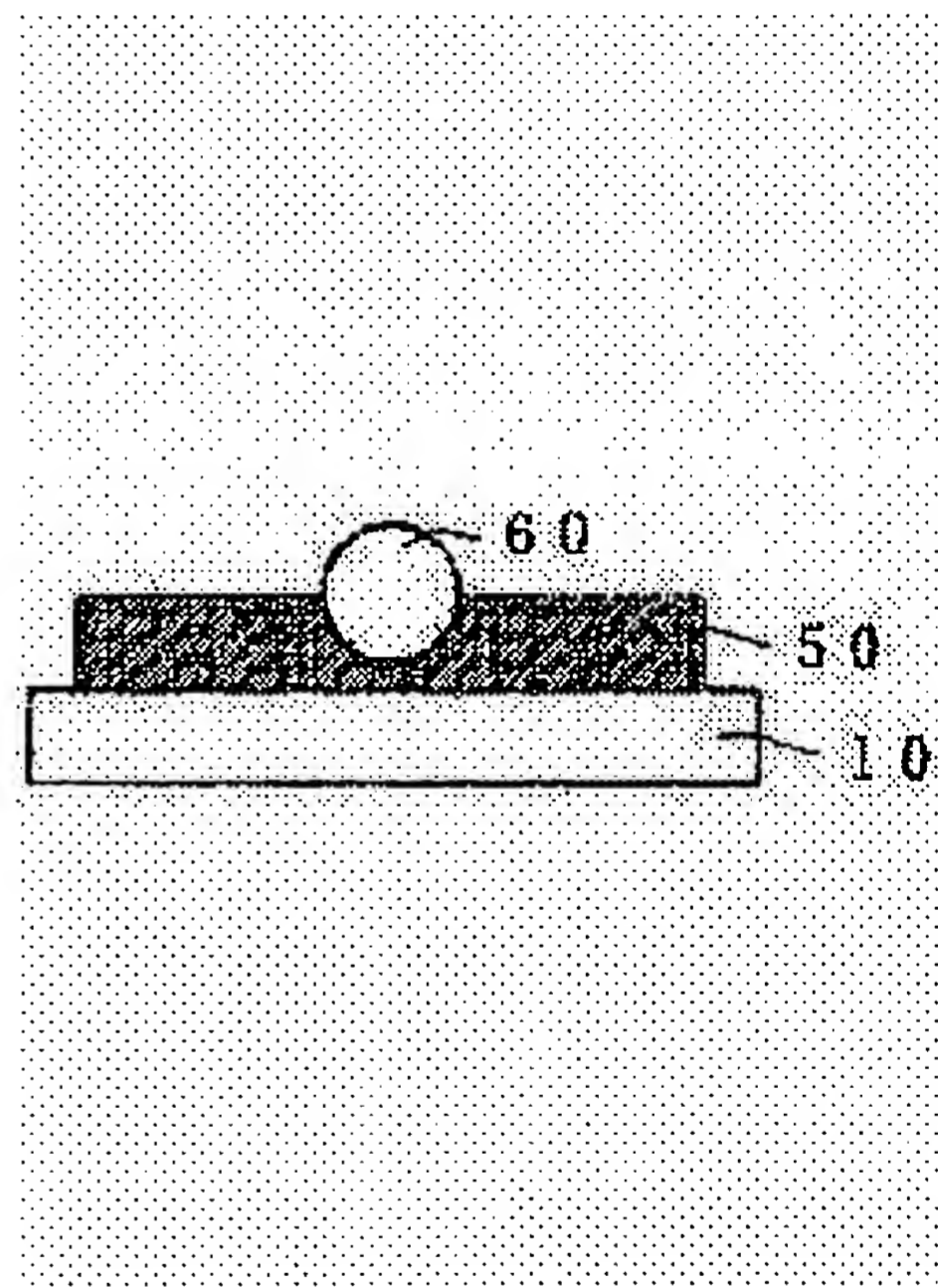
(72)Inventor : NAKAMURA RYUICHI

(54) THICK-FILM PATTERN FORMING METHOD, THICK-FILM PATTERN FORMING JIG,  
AND THICK-FILM PATTERN

(57)Abstract:

PROBLEM TO BE SOLVED: To provide a thick-film pattern having an accurate configuration by pressing a jig using a filament having a cross section shape formed with curves or straight lines onto a thick-film pattern forming material previously applied to a predetermined substrate.

SOLUTION: A thick-film pattern forming material 50 is previously applied to a predetermined substrate 10, and a filament 60 is pressed onto it. As the thick-film pattern forming material 50, for forming a plasma display rib, a material which is formed by mixing inorganic oxide such as titanium oxide and lead oxide with a resin and a solvent, has flexibility before baking, and is hardened after molding is used. This is applied by a means such as screen- printing, roll coat, or die coat. As the filament 60, a metal wire of iron or copper, or nylon or polyester is used. The filament 60 is pressed onto the thick- film pattern forming material 50, and then the filament 60 is removed to provide a thick-film pattern having a space corresponding to the cross section of the filament 60.



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PRIOR ART

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[Description of the Prior Art] the plasma display (it is hereafter written as PDP) which attracts attention as a big screen plane display in recent years although the so-called thick-film pattern is widely used for the electronic circuitry etc. -- thick-film formation technology, such as screen-stencil, is used abundantly at the manufacture.

[0003] For example, as the rib which is the important thick-film pattern which forms the discharge space of PDP is shown in drawing 1, a rib 40 is formed on the electrode 20 formed on the predetermined substrate 10, and a dielectric 30.

[0004] And the rib generally used has structure which connected the inorganic oxide with lead glass and was unified. First, the concrete manufacture method makes it scour each other's suitable resin and suitable solvent, and pastes the impalpable powder of a rib formation material, i.e., an inorganic oxide, and lead glass. And by calcinating, after processing this paste into the configuration of a rib by the predetermined formation method, and dissolving lead glass powder, it is common to connect an inorganic oxide and to unify. In addition, it evaporates or burns and resin and a solvent are removed by the heat applied by this production process.

[0005] Although some methods are enforced by the formation method of this rib, now, the sandblasting method is in use (about a well-known example, it is the \*\*\*\* monthly LCDintelligence August, 1997 issue reference, such as 57 etc. pages). This method is the method of forming a rib by masking a required portion, spraying sand on this, and shaving off an unnecessary rib formation material, after applying a rib formation material to a substrate at predetermined thickness.

[0006] Moreover, the method (it is hereafter written as the pressing method) of forming a pattern was exhibited recently by pushing against the thick-film pattern formation material which applied the metal die, i.e., metal mold, on the substrate beforehand like invention given in JP,10-326571,A as a method of replacing with this.

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DETAILED DESCRIPTION

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[Detailed Description of the Invention]

[0001]

[The technical field to which invention belongs] This invention relates to the formation method of a thick-film pattern, the jig for thick-film pattern formation, and the thick-film pattern formed by that cause.

[0002]

[Description of the Prior Art] the plasma display (it is hereafter written as PDP) which attracts attention as a big screen plane display in recent years although the so-called thick-film pattern is widely used for the electronic circuitry etc. -- thick-film formation technology, such as screen-stencil, is used abundantly at the manufacture.

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[0007]

[Problem(s) to be Solved by the Invention] The trouble of these methods is explained. When producing a rib by the sandblasting method, in order [ so-called ] to produce a rib beginning to delete, most rib formation materials serve as trash, and the cost of materials of a rib becomes high.

[0008] On the other hand, although the pressing method is an outstanding method which trash hardly generates, the metal mold which is the die is very expensive. Moreover, when a blemish arises in metal mold during use, it serves as a defect of the fabricated pattern. And recoverability of the defect of metal mold is impossible as a matter of fact in this case.

[0009] Therefore, as a die, it is cheap and the mold of high degree of accuracy is required.

[0010] The place which it is made in order that this invention may solve such a trouble, and is made into the technical problem can reduce the trash in connection with thick-film pattern formation, and the thick-film pattern obtained while it was cheap is to offer the jig used for the formation method of having an exact configuration and formation of a thick-film pattern of a thick-film pattern, and the thick-film pattern which has the characteristic configuration acquired by that cause.

[0011]

[Means for Solving the Problem] Invention of the 1st of this invention is the formation method of a thick-film pattern characterized by obtaining a thick-film pattern which has space according to a cross-section configuration of the filament concerned by pushing a jig using multifilament which twisted a filament or two or more filaments which have a cross-section configuration constituted by a curve, a straight line, or both sides against a thick-film pattern formation material beforehand applied to a predetermined substrate.

[0012] Invention of the 2nd of this invention is a jig for thick-film pattern formation characterized by arranging densely two or more multifilament which twisted a filament or two or more filaments which have a cross-section configuration constituted by a curve, a straight line, or both sides on the same plane.

[0013] Invention of the 3rd of this invention is a jig for thick-film pattern formation characterized by twisting densely around a cylinder multifilament which twisted a filament or two or more filaments which have a cross-section configuration constituted by a curve, a straight line, or both sides.

[0014] It is the thick-film pattern with which invention of the 4th of this invention is the thick-film pattern formed by thick-film pattern formation method according to claim 1, and the both relation is characterized by being  $D \geq 2H$  when height of the thick-film pattern concerned is set to H and a pitch is set to D.

[0015] Invention of the 5th of this invention is the thick-film pattern formed by thick-film pattern formation method according to claim 1, and is a thick-film pattern characterized by forming very small irregularity in the surface by multifilament which twisted two or more filaments.

[0016]

[Embodiment of the Invention] Hereafter, the gestalt of operation of this invention is explained to details using drawing 7 from drawing 2. However, although it is not what not necessarily restricted circularly the cross-section configuration of a filament according to claim 3 from claim 1 and you could consist of straight lines, such as convex, the filament which has a circular cross-section configuration was used for the drawing for convenience.

[0017] First, as shown in drawing 2, the thick-film pattern formation material 50 is beforehand applied on the predetermined substrate 10, and a filament 60 is forced on it.

[0018] Here, as a thick film pattern formation material 50, although especially the quality of the material be ask, when form said rib of PDP, for example, it be the material which made it scour each other's inorganic oxides, such as titanium oxide and lead oxide, with resin and a solvent, and it have flexibility before baking, and as for after shaping, what be harden be usable, and it should just apply this with well-known means, such as screen-stencil, a roll coat, and a die coat.

[0019] As a filament 60, it is possible to use plastic fiber, such as metal wires, such as iron and copper, nylon, and polyester, etc., and when forming the rib of PDP, 150 micrometers - 400 micrometers are suitable for the diameter.

[0020] After forcing this filament 60 on the thick-film pattern formation material 50, the thick-film pattern which has the space according to the cross section of the filament concerned can be obtained by removing a filament 60.

[0021] And the pattern of the same configuration can be made to arrange regularly by carrying out two or more arrays of the filament, as shown in drawing 3. It can follow, for example, the rib of PDP can be formed.

[0022] By the way, what is necessary is just to produce the jig which carried out two or more arrays of the filament densely on the same plane like drawing 4 like drawing 3, in order to arrange the pattern of the same configuration regularly.

[0023] And as a means which pushes the jig concerned against a thick-film pattern formation material in this case, well-known means, such as a common press by hydrostatic pressure and a roll press, are usable.

[0024] Moreover, it can push against a thick-film pattern formation material, making a predetermined cylinder rotate this using the jig which twisted the filament as a means to arrange the pattern of the same configuration regularly in addition to it, as shown in drawing 5.

[0025] And when the thick-film pattern obtained by these means has a circular filament cross section, as shown in drawing 6, it is equal to the diameter D of the filament which the pitch D, i.e., the gap of a pattern crowning, used, and height H from a pars basilaris ossis occipitalis to a crowning has the relation it is unrelated  $D \geq 2H$ .

[0026] Here, it is set to  $D \geq 2H$  instead of  $D = 2H$  because the part height may become low, since a pitch is removed when passing through a baking production process like the rib of PDP.

[0027] Moreover, when a filament is constituted by the single fiber (monofilament), the smooth surface is obtained, but when the filament (multifilament) which has the almost circular cross-section configuration which twisted two or more filaments those to plastic fiber seen is used, the surface which has minute irregularity peculiar to a filament as shown in drawing 7 is obtained. [ many ]

[0028] Therefore, the thick-film pattern which has the surface roughness according to a use can be obtained by selection of the filament to be used. For example, to the rib of the above-mentioned PDP, effects, such as strengthening the adhesion force of the fluorescent substance to which the rib surface adheres, are acquired by preparing minute irregularity in the surface.

[0029] As mentioned above, the trash in connection with thick-film pattern formation can be reduced by this invention, and the formation method of a thick-film pattern that the thick-film pattern obtained while it was cheap has an exact configuration, the jig for thick-film pattern formation, and the thick-film pattern that has the characteristic configuration acquired by that cause can be formed.

[0030]

[Example] The ethyl cellulose (product made from Kanto chemistry) 5 section and the butyl carbitol (product made from Kanto chemistry) 15 section were added, and by the roll mill, the preparation copper-manganese-cobalt system multiple oxide ( black inorganic pigment made from Asahi Nissan business # 3247) 70 section of a <example 1> (1) thick-film pattern formation material and the hoe lead silicate glass (Nippon Electric Glass make GA-9) 20 section were made to often scour mutually, and were pasted.

[0031] (2) It applied to 200 micrometers in thickness by repeating, carrying out the laminating of printing and the desiccation to soda lime glass (Asahi Glass make), and carrying out them to it by screen-stencil using the screen version with which the solid pattern of 300mm angle was formed, as a spreading substrate to the substrate of a thick-film pattern formation material.

[0032] (3) Using the gut made of nylon (No. 5 diameter of 368 micrometers) as a production filament of the jig for thick-film pattern formation, this was cut to an even length in length of 400mm, and 1000 were densely arranged in the double-sided tape (NITTO DENKO make), and it considered as the jig for thick-film pattern formation.

[0033] (4) Pitch 368micrometer and irregularity with a height of 180 micrometers were formed on the thick-film pattern formation material by putting said jig for thick-film pattern formation on the substrate with which the formation thick-film pattern formation material of a thick-film pattern was applied, and pushing the jig for thick-film pattern formation against a substrate using a hand roller (product made from the Kakuda brush).

[0034] The thick-film pattern which consists of pitch 368micrometer, hoe lead silicate glass with a height of 150 micrometers, and a copper-manganese-cobalt system multiple oxide was obtained by furthermore calcinating this for 30 minutes 580 degrees C all over a hot blast firing furnace.

[0035] The thick-film pattern formation material was prepared like the <example 2> example 1, and this was applied to the substrate.

[0036] (1) The double-sided tape (NITTO DENKO make) was stuck on the aluminum pipe with the production outer diameter of 100mm of the jig for thick-film pattern formation, a thickness [ of 10mm ],

and a width of face of 400mm, and further, the gut made of nylon (No. 5 diameter of 368 micrometers) was densely twisted as a filament on it, and it considered as the jig for thick-film pattern formation.

[0037] (2) By rolling pushing said jig for thick-film pattern formation on the substrate with which the formation thick-film pattern formation material of a thick-film pattern was applied, pitch 368micrometer and irregularity with a height of 180 micrometers were formed on the thick-film pattern formation material.

[0038] The thick-film pattern which consists of pitch 368micrometer, hoe lead silicate glass with a height of 150 micrometers, and a copper-manganese-cobalt system multiple oxide was obtained by furthermore calcinating this for 30 minutes 580 degrees C all over a hot blast firing furnace.

[0039] The thick-film pattern which has the irregularity of about 30 micrometers on the surface was obtained in a height of about 150 micrometers with the jig which used the multifilament which twisted 21 guts made of nylon with a <example 3> diameter of 75 micrometers instead of the filament in an example 2.

[0040]

[Effect of the Invention] By the formation method of the thick-film pattern shown in claim 1 of this invention, the amount of trash can make it a simpler production process few compared with the conventional method.

[0041] The cheap jig which forms the thick-film pattern which has the surface roughness according to a use by selection of the filament which can form the thick-film pattern of the exact configuration which has relation with fixed pitch and height, and is used with the jig for formation of the thick-film pattern shown in claim 2 and claim 3 can be created.

[0042] Effects, like with the thick-film pattern shown in claim 4 and claim 5, irregularity with the very small surface strengthens the adhesion force of the fluorescent substance to which the rib surface adheres to the rib of PDP are acquired.

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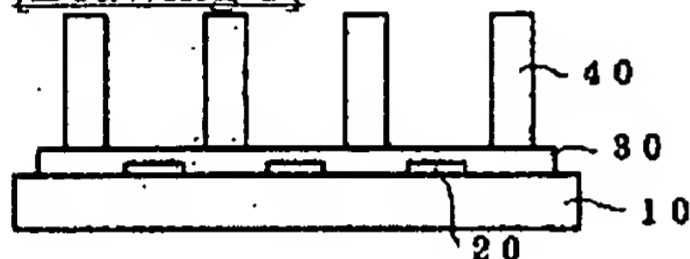
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## DRAWINGS

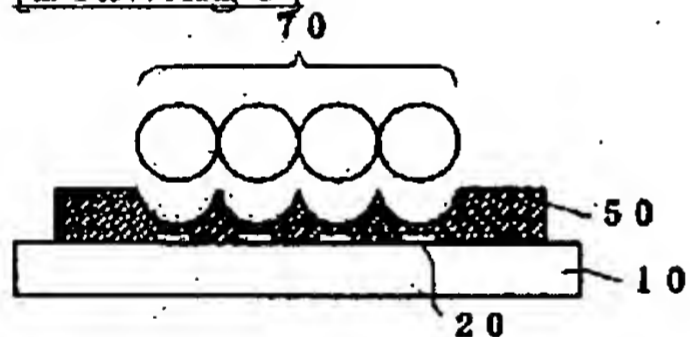
[Drawing 1]



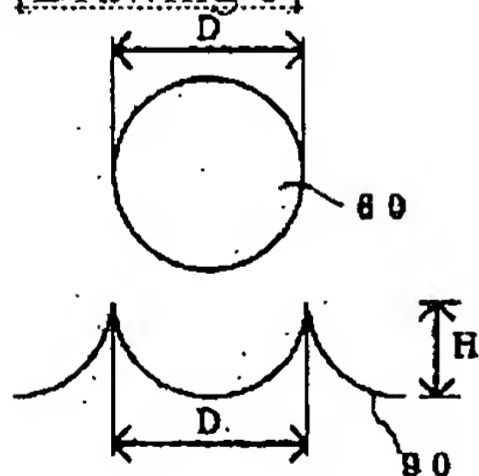
[Drawing 2]



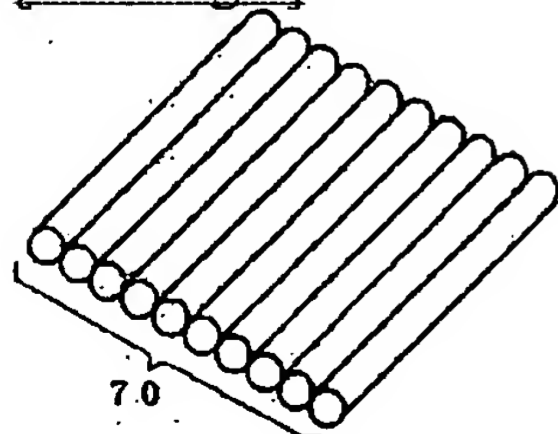
[Drawing 3]



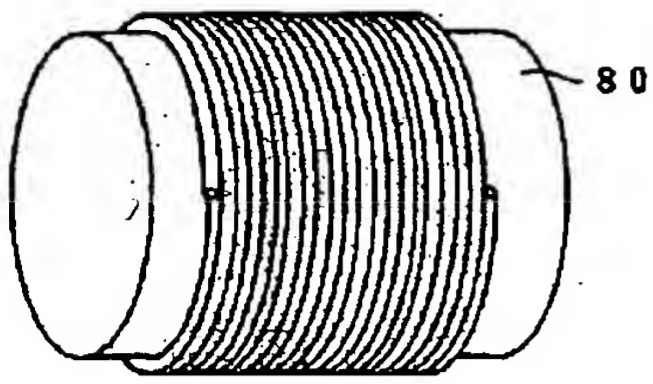
[Drawing 6]



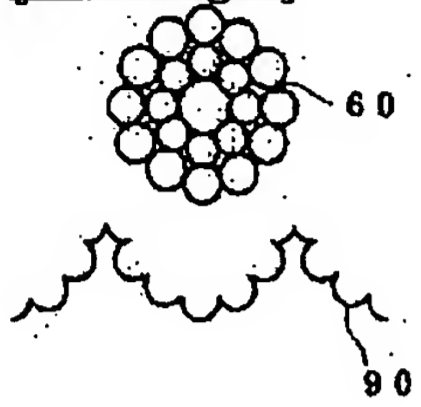
[Drawing 4]



[Drawing 5]



[Drawing 7]



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